SCIENCE:

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES

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SCIENCE IN NEW ZEALAND.[1]

WHEN I rashly replied in the affirmative to the cablegram which I received from our secretary in Melbourne, asking me to undertake the honorable and responsible duties which I have to commence this evening, I fear I did not fully realize the difficulties of the position; but since then the sense of my unfitness for the task has become very oppressive. To address an assembly of this kind on general science must involve unusual difficulties, owing to the audience being largely composed of those who, only taking a casual interest in scientific discussions, look chiefly to the results; while, at the same time, there are present professional specialists in almost every branch of knowledge. I feel that on this occasion I must be ruled by the interest of the majority, and claim the forbearance of my fellow-workers in science if I have to refer in a sketchy way to subjects in which they are deeply interested, and far more learned than I profess to be.

Seeing that I am addressing a Christchurch audience, I hope I may be permitted, in the first place, to say a word concerning one whose scientific services should, without doubt, have obtained for him the position of first president in New Zealand of the Australasian Association. We naturally recall the name of Sir Julius von Haast on this occasion, and mourn for the loss the colony has sustained of one who for thirty years occupied a most prominent position. His early researches in the North Island, in company with Von Hochstetter, were followed by the exploration of the remote districts on the west coast of Nelson, after which Canterbury secured his distinguished services, and enabled him to leave that monument of his varied scientific knowledge, shrewd capacity, and indefatigable industry, which is to be found in the Canterbury Museum.

There are others of our fellow-colonists whose wide range of experience would have peculiarly fitted them to act as your president; and I am able to say, that, had our veteran colonist and explorer Sir George Grey felt more assured in health and strength, it would have been your pleasure this evening to listen to a flood of eloquence on all scientific topics that relate to the future development of Australasia. There is another name I feel must be mentioned as one who should have been in this position had his health permitted. I refer to the Rev. William Colenso, who is not only the greatest authority on the folk-lore of the Maoris, on whom he was among the first to confer a printed literature in their own language, but whose long-continued work as a field naturalist, and especially as a botanist, is exceedingly interesting, seeing that it forms a connecting link that has continued the early spirit of natural-history research in New Zealand, that commenced with Banks and Solander, and was continued by Menzies, Lesson, the two Cunninghams, and Sir Joseph Hooker, prior to the arrival of colonists. Thus we still have in my esteemed friend, Mr. Colenso, an active veteran naturalist of what we may call the old school of explorers.

It is wonderful to reflect that little more than fifty years ago this European colony was represented by a few fishing hamlets on the seaboard of a country occupied by a considerable native population. To the early explorers, and even down to a much later date, the obstacles that beset their path were very different from those of the present time,— often obstructive natives, no roads, no steamers, no railways. Had an association then existed, and desired to promote science by giving our visitors an opportunity of visiting the remote parts of the islands, the same excursions which have on this occasion been planned to occupy a few days, would have occupied as many months, and then be accomplished only with great hardship and difficulty. I must ask the young and rising generation of colonial naturalists to bear this in mind when they have to criticise and add to the work of their predecessors. Such names of early colonists as Bidwill, Sinclair, Monro, Mantell, Travers, and may others, should ever be held in esteem as those who, amidst all the arduous trials of early colonization, never lost sight of their duty towards the advancement of science in New Zealand. I will not attempt to particularize other names from among our existing, and, though small in number, very active, corps of scientific workers. They are here, or should be, to speak for themselves in the sectional work; and I have no doubt some of those who did me the great honor of placing me in my present position are secretly congratulating themselves that they have secured for themselves the position of free lances on this occasion.

This is now the third annual gathering of this association, and New Zealand should feel honored that it has at so early a date in the association's history been selected to the turn in rotation as the place of meeting among so many divisions of the great colony of Australasia. The two volumes of the "Transactions" of the association, already in the hands of members, are quite sufficient to prove that the hopes of its founders — or, rather, I may almost say, the founder, Professor Liversidge of Sydney — have been amply fulfilled.

The papers read before the different sections, and the addresses delivered, have, in my opinion, to a most remarkable extent embodied information and discussions which were not likely to have been produced as the result of any of our local scientific organizations. The authors seemed to have felt it incumbent on them to place their subjects in the environment of Australasia, and not in relation to the colony they happened to represent. This, I take it, is the first truly effective step towards federation which has yet been achieved, and I trust that all our members will continue to be imbued with this spirit. Politicians should take this well to heart. Let them continue to aid all efforts that will tend to bring scientific accumulations in these colonies into a common store; so that each may discover for what purpose it has been best adapted by nature, and, by paying proper political respect in fiscal policy to one another, each may prosper to the full extent of its natural advantages. But it is not alone in the value of the papers communicated the association contributes to advance true civilization in the colonies. The face-to-face conference, the personal contact of the active workers in different lines of scientific work, must greatly facilitate the more thorough understanding of the work which has been done, and which is still undone. A vague idea, simmering in the brain of one scientist, who thinks light of it because it has no special application in his particular environment, may, by personal converse, flash into important results in the mind of another who has had the difficulties facing him, but without the happy thought occurring. It would be rather interesting for some one with leisure to endeavor to recount how many great discoveries have eventuated in this manner.

In casting my thoughts for a particular subject on which to address the association, I felt perplexed. Presidents of similar associations in the Old World, who are in constant contact with the actual

[1] Address of the president of the Australasian Association for the Advancement of Science, Christchurch, Jan. 16, 1891.

progress in scientific thought, feel that a mere recital of the achievements during their previous term is sufficient to command interest: but in the colonies most of us are cut off from personal converse with the leading minds by whom the scientific afflatus is communicated; and, in our suspense for the tardy arrival of the official publications of the societies, we have to feed our minds with science from periodical literature. But even in this respect my own current education is very defective, as I reside in the capital city of New Zealand, which has no college with a professional staff whose duty, pleasure, and interest it is to maintain themselves on a level with the different branches of knowledge they represent. I therefore decided, that, instead of endeavoring to review what had been done in the way of scientific progress, even in Australasia, it would be better to confine my remarks to New Zealand; the more so, that this is the first occasion that there has been a gathering of what must, to some extent, be considered to be an outside audience for the colony.

To endeavor to describe, even briefly, the progress made in the science of a new country, is, however, almost like writing its minute history. Every step in its reclamation from a wild state of nature has depended on the application of scientific knowledge, and the reason for the rapid advance made in these colonies is chiefly to be attributed to their having had the advantage of all modern resources ready to hand. As in most other matters in New Zealand, there is a sharp line dividing the progress into two distinct periods,— the first before, and the second after, the formation of the colony in 1840.. With reference to the former period, it is not requisite that much should be said on this occasion. From the time of Capt. Cook's voyages, owing to his attractive narrative, New Zealand acquired intense interest for naturalists. His descriptions of the country and its productions, seeing that he only gathered them from a few places where he landed on the coast, are singularly accurate; but I think rather too much is sometimes endeavored to be proved from the negative evidence of his not having observed certain objects. As an instance, it has been asserted, that, if any of the many forms of the moa still survived, Capt. Cook must have been informed of the fact. Yet we find that he lay for weeks in Queen Charlotte Sound and in Dusky Sound, where all night long the cry of the kiwi must have been heard, just as now; and that he also obtained and took home mats and other articles of native manufacture, trimmed with kiwis' skins; and that most likely the mouse-colored quadruped which was seen at Dusky Sound by his men when clearing the bush was only a gray kiwi; and yet the discovery of this interesting bird was not made till forty years after Cook's visit. As a scientific geographer, Capt. Cook stands unrivalled, considering the appliances at his disposal. His longitudes of New Zealand are wonderfully accurate, especially those computed from what he called his "rated watches," the first type of the modern marine chronometer, which he was almost the first navigator to use. The result of a recent measurement of the meridian difference from Greenwich by magnetic signals is only two geographical miles east of Capt. Cook's longitude. He also observed the variation and dip of the magnetic needle; and from his record it would appear, that, during the hundred years which elapsed up to the time of the "Challenger's" visit, the south-seeking end of the needle has changed its position $2\frac{1}{2}°$ westward, and inclines $1\frac{1}{2}°$ more towards the south magnetic pole. Capt. Cook also recorded an interesting fact, which, so far as I am aware, has not been since repeated or verified in New Zealand. He found that the pendulum of his astronomical clock, the length of which had been adjusted to swing true seconds at Greenwich, lost at the rate of forty seconds daily at Ship Cove, in Queen Charlotte Sound. This is, I believe, an indication of a greater loss of the attraction of gravity than would occur in a corresponding north latitude.

The additions to our scientific knowledge of New Zealand, acquired through the visits of the other exploring ships of early navigators, the settlement of sealers and whalers on the coast, and of pakeha Maoris in the interior, were all useful, but of too slight a character to require special mention. The greatest additions to science were made by the missionaries, who, in the work of spreading Christianity among the natives, had the services of able and zealous men, who mastered the native dialects, reduced them to a written language, collected and placed on record the traditional knowledge of the interesting Maori, and had among their numbers some industrious naturalists, who never lost an opportunity of collecting natural objects.

The history of how the country, under the mixed influences for good and for evil which prevailed almost without government control until 1840, gradually was ripened for the colonist, is familiar to all. The new era may be said to have begun with Dieffenbach, a naturalist who was employed by the New Zealand Company. He travelled, and obtained much information, but did not collect to any great extent, and, in fact, appears not to have anticipated that much remained to be discovered: for his conclusion is, that the smallness of the number of the species of animals and plants then known — about one-tenth of our present lists — was not due to want of acquaintance with the country, but to paucity of life forms. The chief scientific value of his published work is in the appendix, giving the first systematic list of the fauna and flora of the country, the former being compiled by the late Dr. Gray of the British Museum. The next great scientific work done for New Zealand was the admiralty survey of the coast-line, which is a perfect marvel of accurate topography, and one of the greatest boons the colony has received from the mother country. The enormous labor and expense which was incurred on this survey at an early date in the history of the colony is a substantial evidence of the confidence in its future development and commercial requirements which animated the home government.

On the visit of the Austrian exploring ship "Novara" to Auckland in 1859, Von Hochstetter was left behind, at the request of the government, to make a prolonged excursion to the North Island and in Nelson; and he it was who laid the foundation of our knowledge of the stratigraphical geology of New Zealand. Since then the work of scientific research has been chiefly the result of State surveys, aided materially by the zeal of members of the New Zealand Institute, and of late years by an increasing band of young students, who are fast coming to the front under the careful science training that is afforded by our university colleges.

In the epoch of their development, the Australasian colonies have been singularly fortunate. The period that applies to New Zealand is contemporaneous with the reign of her Majesty, which has been signalized by enormous strides in science. It has been a period of gathering into working form immense stores of previously acquired observation and experiment, and of an escape of the scientific mind from the trammels of superstition and hazy speculation regarding what may be termed common things. Laborious work had been done, and many grand generalizations had been formerly arrived at in physical science; but still, in the work of bringing things to the test of actual experiment, investigators were still bound by imperfect and feeble hypotheses and supposed natural barriers among the sciences. But science is one and indivisible; and its subdivisions, such as physics, chemistry, biology, are only matters of convenience for study. The methods are the same in all, and their common object is the discovery of the great laws of order under which this universe has been evoked by the great supreme Power.

The great fundamental advance during the last fifty years has been the achievement of far-reaching generalizations, which have provided the scientific worker with powerful weapons of research. Thus the modern "atomic theory," with its new and clearer conceptions of the intimate nature of the elements and their compounds that constitute the earth and all that it supports, has given rise to a new chemistry, in which the synthetical or building-up method of proof is already working marvels in its application to manufactures. It is, moreover, creating a growing belief that all matter is one, and reviving the old idea that the inorganic elementary units are merely centres of motion specialized in a homogeneous medium; and that these units have been continued on through time, but with such individual variations as give rise to derivative groups, just as we find has been the case in the field of organic creations. The idea embodied in this speculation likens the molecule to the vortex ring which Helmholtz found

must continue to exist forever, if in a perfect fluid free from all friction they are once generated, as a result of impacting motion.

There is something very attractive in the simplicity of this theory of the constitution of matter which has been advocated by Sir William Thomson. He illustrates it by likening the form of atoms to smoke-rings in the atmosphere, which, were they only formed under circumstances such as above described, must continue to move without changing form, distinguished only from the surrounding medium by their motion. As long as the original conditions of the liquid exist, they must continue to revolve. Nothing can separate, divide, or destroy them; and no new units can be formed in the liquid without a fresh application of creative impact.

The doctrine of the conservation of energy is a second powerful instrument of research that has developed within our own times. How it has cleared away all the old cobwebs that formerly incrusted our ideas about the simplest agencies that are at work around us! How it has so simplified the teaching of the laws that order the conversion of internal motions of bodies into phases which represent light, heat, electricity, is abundantly proved by the facility with which the mechanicians are every day snatching the protean forms of energy for the service of man with increasing economy. These great strides which have been made in physical science have not as yet incited much original work in this colony. But, now that physical laboratories are established in some degree at the various college centres, we will be expected, ere long, to contribute our mite to the vast store.

In practical works of physical research we miss in New Zealand the stimulus the sister colonies receive from their first-class observatories, supplied with all the most modern instruments of research, wielded by such distinguished astronomers as Ellery, Russell, and Todd, whose discoveries secure renown for their separate colonies. I am quite prepared to admit that the reduplication of observatories in about the same latitude, merely for the study of the heavenly bodies, would be rather a matter of scientific luxury. The few degrees of additional elevation of the south polar region which would be gained by an observatory situated even in the extreme south of New Zealand could hardly be expected to disclose phenomena that would escape the vigilance of the Melbourne Observatory. But star-gazing is only one branch of the routine work of an observatory. It is true that we have a moderate but efficient observatory establishment in New Zealand, sufficient for distributing correct mean time, and that our meridian distance from Greenwich has been satisfactorily determined by telegraph; also, thanks to the energy and skill of the Survey Department, despite most formidable natural obstructions, the major triangulation and meridian circuits have established the basis of our land-survey maps on a satisfactory footing, so that subdivisions of the land for settlement, and the adoption and blending of the excellent work done by the provincial governments of the colony, are being rapidly overtaken. Further, I have already recalled how much the colony is indebted to the mother country for the completeness and detail of the coastal and harbor charts, but there is much work that should be controlled by a physical observatory that is really urgently required. I may give a few illustrations. The tidal movements round the coast are still imperfectly ascertained, and the causes of their irregular variations can never be understood until we have a synchronous system of tide-meters, and a more widely extended series of deep-sea soundings. Excepting the "Challenger" soundings on the line of the Sydney cable, and a few casts taken by the United States ship "Enterprise," the depths of the ocean surrounding New Zealand has not been ascertained with that accuracy which many interesting problems in physical geography and geology demand. It is supposed to be the culmination of a great submarine plateau; but how far that plateau extends, connecting the southern islands towards the great Antarctic land, and how far to the eastward, is still an unsolved question. Then, again, the direction and intensity of the magnetic currents in and around New Zealand require further close investigation, which can only be controlled from an observatory.

Even in the matter of secular changes in the variation of the compass we find that the marine charts instruct that an allowance of increased easterly variation of two minutes per annum must be made, and, as this has now accumulated since 1850, it involves a very sensible correction to be adopted by a shipmaster in making the land or standing along the coast; but we find from the recently published work of the "Challenger" that this tendency to change has for some time back ceased to affect the New Zealand area, and as the deduction appears only to have been founded on a single triplet observation of the dip taken at Wellington, and one azimuth observation taken off Cape Palliser, it would be well to have this fact verified. With regard to the local variation in the magnetic currents on land and close in shore, the requirement for exact survey is even more imperative. Capt. Creak, in his splendid essay, quotes the observations made by the late surveyor-general, Mr. J. T. Thomson, at the Bluff Hill, which indicate that a compass on the north side was deflected more than 9° to the west, while on the east side of the hill the deflection is 46° to the east of the average deviation in Foveaux Strait. He adds that if a similar island-like hill happened to occur on the coast, but submerged beneath the sea to a sufficient depth for navigation, serious accidents might take place; and he instances a case near Cossack, on the north coast of Australia, when H. M. Medea, sailing on a straight course in eight fathoms of water, experienced a compass deflection of 30° for the distance of a mile.

A glance at the variation entered on the meridian circuit maps of New Zealand shows that on land we have extraordinary differences between different trigonometrical stations at short distances apart. For instance: in our close vicinity, at Mount Pleasant, behind Godley Head lighthouse, at the entrance to Lyttelton harbor, the variation is only 9° 3′ east, or 6° less than the normal; while at Rolleston it is 15° 33′, and at Lake Coleridge 14° 2′. In Otago we have still greater differences recorded, for we find on Flagstaff Hill, which is an igneous formation, 14° 34′, while at Nenthorn, thirty miles to the north, in a schist formation, we find an entry of 35° 41′.

In view of the fact that attention has been recently directed to the marked effects on the direction and intensity of the terrestrial magnetic currents of great lines of fault along which movements have taken place, such as those which bring widely different geological formations into discordant contact, with the probable production of mineral veins, this subject of special magnetic surveys is deserving of being undertaken in New Zealand. In Japan and in the United States of America the results have already proved highly suggestive. A comparison between this country and Japan by such observations, especially if combined with systematic and synchronous records by modern seismographic instruments, would be of great service to the physical geologist.

There are many features in common, and many quite reversed, in the orographic and other physical features of these two countries. Both are formed by the crests of great earth-waves lying north-east and south-west, and parallel to, but distant from, continental areas; and both are traversed by great longitudinal faults and fissures, and each by one great transverse fault. Dr. Nauman, in a recent paper, alludes to this in Japan as the *Fossa Magna;* and it corresponds in position in relation to Japan with Cook Strait in relation to New Zealand. But the *Fossa Magna* of Japan has been filled up with volcanic products, and is the seat of the loftiest active volcano in Japan. In Cook Strait and its vicinity, as you are aware, there are no volcanic rocks; but there and southward, through the Kaikouras, evidence of fault movements on a larger scale is apparent. It would be most interesting to ascertain if the remarkable deviation from the normal, in direction and force of the magnetic currents, which are experienced in Japan, are also found in New Zealand: for it is evident, that, if they are in any way related to the strain of cross-fractures in the earth's crust, the observation would tend to eliminate the local influence of the volcanic rocks which are present in one case and absent in the other.

With reference to earthquakes also, few, if any, but very local shocks experienced in New Zealand have originated from any volcanic focus we are acquainted with, while a westerly propagation of the ordinary vibrations rarely passes the great fault that marks the line of active volcanic disturbance. In Japan, also, out of about 480 shocks which are felt each year in that country, each of

which, on an average, shakes about one thousand square miles, there are many that cannot be ascribed to volcanic origin.

There are many other problems of practical importance that can only be studied from the base-line of a properly equipped observatory. These will readily occur to physical students, who are better acquainted with the subject than I am. I can only express the hope that the improved circumstances of the colony will soon permit some steps to be taken. Already in this city, I understand, some funds have been subscribed. As an educational institution, to give practical application to our students in physical science, geodesy, and navigation, it would clearly have a specific value that would greatly benefit the colony.

Another great branch of physical science, chemistry, should be of intense interest to colonists in a new country. Much useful work has been done, though not by many workers. The chief application of this science has been naturally to promote the development of mineral wealth, to assist agriculture, and for the regulation of mercantile contracts. I cannot refrain from mentioning the name of William Skey, analyst to the Geological Survey, as the chemist whose researches during the last twenty-eight years have far surpassed any other in New Zealand. Outside his laborious official duties, he has found time to make about sixty original contributions to chemical science: such as his investigation into the electrical properties of metallic sulphides; the discovery of the fero-nickel alloy awaruite in the ultra-basic rocks of West Otago, which is highly interesting, as it is the first recognition of this meteoric-like iron as native to our planet; the discovery that the hydrocarbon in torbasic and the gas shales is chemically, and not merely mechanically, combined with the clay base; and his discovery of a remarkable color-test for the presence of magnesia and the isolation of the poisonous principle in many of our native shrubs. His recent discovery, that the fatty oils treated with aniline form alkaloids, also hints at an important new departure in organic chemistry. His suggestion of the hot air blowpipe, and of the application of cyanide of potassium to the saving of gold, and many other practical applications of his chemical knowledge, are distinguished services to science, of which New Zealand should be proud.

In connection with the subject of chemistry, there is a point of vast importance to the future of the pastoral and agricultural interests of New Zealand, to which attention was directed some years ago by Mr. Pond of Auckland; that is, the rapid deterioration which the soil must be undergoing by the steady export of the constituents on which plant and animal life must depend for nourishment. He calculated that in 1883 the intrinsic value of the fixed nitrogen and phosphoric acid and potash sent out annually was £592,000, taking into account the wool and wheat alone. Now that we have to add to that the exported carcasses of beef and mutton, bones and all, the annual loss must be immensely greater. The proper cure would, of course, be to bring back return cargoes of artificial manure, but even then its application to most of our pastoral lands would be out of the question. I sincerely hope that the problem will be taken in hand by the Agricultural College at Lincoln as a matter deserving of practical study and investigation.

I have already referred to several great generalizations which have exercised a powerful influence in advancing science during the period I marked out for review; but so far as influencing the general current of thought, and almost entirely revolutionizing the prevalent notions of scientific workers in every department of knowledge, the most potent factor of the period has been the establishment of what has been termed "the doctrine of evolution." The simple conception of the relation of all created things by the bond of continuous inheritance has given life to the dead bones of an accumulated mass of observed facts, each valuable in itself, but as a whole breaking down by its own weight. Before this master-key was provided by the lucid instruction of Darwin and Wallace, it was beyond the power of the human mind to grasp and use in biological research the great wealth of minute anatomical and physiological details. The previous ideas of the independent creation of each species of animal and plant in a little Garden of Eden of its own must appear puerile and absurd to the young naturalists of the present day; but in my own college days to have expressed any doubt on the subject would have involved a sure and certain pluck from the examiner. I remember well that I first obtained a copy of Darwin's "Origin of Species" in San Francisco, when on my way home from a three-years' sojourn among the red Indians in the Rocky Mountains. Having heard nothing of the controversies, I received the teaching with enthusiasm, and felt very much surprised, on returning to my *alma mater*, to find that I was treated as a heretic and a backslider. Nowadays it is difficult to realize what all the fuss and fierce controversy was about; and the rising school of naturalists have much cause for congratulation that they can start fair on a well-assured logical basis of thought, and steer clear of the many complicated and purely ideal systems which were formerly in vogue for explaining the intentions of the Creator, and for torturing the unfortunate students. The doctrine of evolution was the simple-minded acceptance of the invariability of cause and effect in the organic world, as in the inorganic; and to understand his subject in any branch of natural science, the learner has now only to apply himself to trace in minutest detail the successive steps in the development of the phenomena he desires to study.

With energetic leaders educated in such views, and who, after their arrival in the colony, felt less controversial restraint, it is not wonderful that natural history, and especially biology, should have attracted so many ardent workers, and that the results should have been so good. A rough test may be applied by comparing the number of species of animals and plants which had been described before the foundation of the colony, and those up to the present time. In 1840 Dr. Gray's list in Deiffenbach's work gives the number of described species of animals as 594. The number now recognized and described is 5,498. The number of *Mammalia* has been doubled through the more accurate study of our seals, whales, and dolphins. Then the list of birds has been increased from 84 to 195, chiefly through the exertions of Sir Walter Buller, whose great standard work on our avifauna has gained credit and renown for the whole colony. The number of fishes and *Mollusca* has been much more than trebled, almost wholly by the indefatigable work of our secretary, Professor Hutton. But the greatest increase is in the group which Dr. Gray placed as *Annulosa*, which, chiefly through the discovery of new forms of insect-life, has risen from 156 in 1840, to 4,295, of which 2,000 are new beetles described by Capt. Broun of Auckland.

When we turn to botany, we find that Deiffenbach, who appears to have carefully collected all the references to date in 1840, states that the flora comprised 632 plants of all kinds, and, as I have already mentioned, did not expect that many more would be found. But by the time of the publication of Hooker's "Flora of New Zealand" (1863), a work which has been of inestimable value to our colonists, we find the number of indigenous plants described had been increased to 2,456. Armed with the invaluable guidance afforded by Hooker's "Handbook," our colonial botanists have renewed the search, and have since then discovered 1,469 new species, so that our plant census at the present date gives a total of 3,355 species.

It would be impossible to make mention of all who have contributed to this result as collectors, and hardly even to indicate more than a few of those to whom science is indebted for the description of the plants. The literature of our post-Hookerian botany is scattered about in scientific periodical literature; and, as Hooker's "Handbook" is now quite out of print, it is obvious that, as the new discoveries constitute more than one-third of the total flora, it is most important that our young botanists should be fully equipped with all that has been ascertained by those who have preceded them. I am glad to be able to announce that such a work, in the form of a new edition of the "Handbook of the Flora of New Zealand," approved by Sir Joseph Hooker, is now in an advanced state of preparation by Professor Thomas Kirk, who has already distinguished himself as the author of our "Forest Flora." Mr. Kirk's long experience as a systematic botanist, and his personal knowledge of the flora of every part of the colony, acquired during the exercise of his duties as conservator of forests, point to him as the fitting man to undertake the task.

But quite apart from the work of increasing the local collections

which bear on biological studies, New Zealand stands out prominently in all discussions on the subject of geographical biology. It stands as a lone zoölogical area, minute in area, but on equal terms, as far as regards the antiquity and peculiar features of its fauna, with nearly all the larger continents in the aggregate. In consequence of this, many philosophical essays — such, for instance, as Hooker's introductory essay to the early folio edition of the "Flora;" the essays by Hutton, Travers, and others; and also the New Zealand references in Wallace's works — have all contributed essentially to the vital question of the causes which have brought about the distribution and geographical affinities of plants and animals, and have thus been of use in hastening the adoption of the doctrine of evolution.

Much still remains to be done. Both as regards its fauna and its flora, New Zealand has always been treated too much as a whole quantity; and in consequence percentage schedules, prepared for comparing with the fauna and flora of other areas, fail from this cause. It is absolutely necessary not only to discriminate localities, but also to study more carefully the relative abundance of individuals as well as of species before instituting comparisons. The facility and rapidity with which change is effected at the present time should put us against rashly accepting species which may have been accidental intruders, though wafted by natural causes, as belonging to the original endemic fauna or flora. Further close and extended study, especially of our marine fauna, is urgently required. We have little knowledge beyond the littoral zone, except when a great storm heaves up a gathering of nondescript or rare treasure from the deep. Of dredging we have had but little done, and only in shallow waters, with the exception of a few casts of the deep-sea trawl from the "Challenger." When funds permit, a zoölogical station for the study of the habits of our sea-fishes, and for the propagation of such introductions as the lobster and crab, would be advantageous. I observe that lately such an establishment has been placed on the Island of Mull, in Scotland, at a cost of £400, and that it is expected to be nearly self-supporting. With respect to food-fishes, and still more with respect to some terrestrial forms of life, we, in common with all the Australasian colonies, require a more scientific and a less casual system of acclimatization than we have had in the past.

One must talk with bated breath of the injuries that have been inflicted on these colonies by the rash disturbance of the balance of nature. Had our enthusiasm been properly controlled by foresight, our settlers would probably not have to grieve over the losses they now suffer through many insect-pests, through small birds and rabbits, and which they will in the future suffer through the vermin that are now being spread in all directions.

HEALTH MATTERS.

Why the Stomach does not digest Itself.

FROM a new study of this subject Dr. E. Sehrwald announces the following conclusions (*Medical Record*, March 7, 1891): 1. The balance between the alkali of the blood and the acid of the gastric juice does not follow, during life, the law of diffusion, but moves in narrower limits; 2. The self-digestion of the stomach is partly prevented by the alkalinity of the blood, and partly by cell-action; 3. The living epithelium interposed between the blood and the gastric juice prevents their mutual neutralization, and preserves the alkalinity of the blood and the acidity of the gastric juice; 4. By this protection the stomach is spared a great deal of work of secretion and absorption; 5. The protection furnished by the flowing blood is partly due to its alkalinity, and partly to its properties as a nutritive liquid; 6. All influences which arrest the nutrition of the cells of the walls of the stomach may lead to self-digestion and ulceration. The conditions which may be mentioned in this connection are, first, disturbances in the circulation; second, direct injury to the epithelium; and, third, injuries of the trophic nerves.

Cremation and its Safeguards.

The *Lancet*, Jan. 31, 1891, says, "Unfortunate circumstances connected with the death of the late Duke of Bedford have brought into prominence an important question respecting the procedure of the Cremation Society, of which the late duke was a prominent member, in cases of death from other than purely natural causes. It is clear that in the case of the society absolute certainty as to the cause of death, when other than natural, can alone justify the preferential application of its method. It will therefore be interesting to examine the practical value of the safeguards adopted by the society to prevent the chances of fallacy in a matter so important. These are three: namely, (1) the certificate of the medical practitioner in attendance on the deceased during his last illness; (2) a second independent certificate by another practitioner after careful inquiry into the circumstances attending the illness; and (3), should any doubt remain, the evidence afforded by necropsy.

"A further, though possibly less permanent, security exists in the resolution of the society to refuse cremation in any case where the least doubt exists respecting the cause of death. Such doubt, as observed by Sir Henry Thompson, could remain after necropsy only in an extremely small number of cases, and would, in fact, be virtually abolished. Not actually so, however. There still remains a minimum uncertainty; and this, it is apparent, is much greater where certification, even on the very careful system employed by the society, is alone relied upon. The practitioner in attendance might, in spite of diligence and skill, be misled; for example, in a case where the signs of poison were obscurely blended with those of real or supposed disease. In this connection the case of the late Mr. Maybrick is suggestive. Is it, then, to be believed that a second medical testimony, which would be independent of the former, could be relied on to guarantee the difference of opinion which would necessitate an appeal to the coroner? We should rather expect that this latter evidence, divested as it must be of various technical premises which guided the statements in the first certificate, would be at best a carefully weighed and usually confirmatory assertion of moral certainty.

"After all, it is probable that the most reliable safeguard against a too precipitate practice of cremation which we possess is to be found in the resolutions of the society above mentioned. Cremation, therefore, under its present rules, is certainly a valuable means of promoting accuracy in certification. As affording an absolute guaranty of such accuracy, it cannot be depended on, while it must in all cases destroy every trace of morbid or mischievous agency contained in the tissues. While, therefore, we freely admit its practical security against any miscarriage of justice in the vast majority of cases, we cannot admit that it stands in this respect on a level exactly so high as the practice of burial. Moreover, while we also recognize its more absolute and destructive purity in the disposal of infectious dead, we do not see that it possesses any such advantage in comparison with burial in other cases, provided that burial be conducted, as it increasingly is conducted, on a rational or 'earth to earth' system."

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

The Motion of Storms and High Areas.

THERE was presented in this journal Feb. 27 a short discussion of the origin and motion of waves of heat and cold. I desire to still further discuss this question under an analogous heading. In the previous note it is possible that too much prominence was given to the occurrence of temperature falls in the rear of storms when there were no high areas near. These falls seem to be accompaniments of storms, but are of very limited extent and slight intensity. They seem to be due largely to radiation from the air and earth to the clear sky.

It may conduce to clearness if several propositions are advanced and discussed.

1. *Storms and High Areas have the Same Velocity.*— If this were not so, the one would overtake the other when they were moving along the same line. Of course, there may be such conditions, on any map, in different lines, which have widely different velocities.